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FILM, SURFACE, AND BULKY COLORS AND THEIR INTERMEDIATES¹

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TABLE OF CONTENTS

	PAGE
I. INTRODUCTION.....	451
II. SURFACE TO FILM	
Series I. Effect of varying size of hole.....	455
Series II. Effect of localization.....	464
Series III. Observations of familiar objects.....	468
III. BULK TO FILM	
Series IV. Episcotister before surface with fixation point.....	469
Series V. Episcotister before surface without fixation point.....	472
Series VI. Control Series.....	475
IV. THE MONOCULAR FILM	
Series VII. Holes of various sizes.....	476
Series VIII. Monocular observations with episcotister..	478
V. CONCLUSIONS.....	479

I. INTRODUCTION

Katz has made us familiar with a mass of detail concerning the various modes of appearance of colors, which were first hinted at by Hering.² There is a general tendency among psychologists to accept Katz' detail, but there seems to have been no definite effort made to confirm it from the foundation. This work of verification, desirable in itself, is all the more important because Katz' interest lay not so much in phenomenology for its own sake as in other and more special problems. For these reasons we have attempted a further study of those modes of appearance which seem fundamental.

¹From the Psychological Laboratory of Cornell University.

²D. Katz, *Die Erscheinungsweisen der Farben*, 1911.

In the opening chapter of his book Katz describes and compares eight modes of appearance: (1) film colors (*Flächenfarben*),³ (2) surface colors (*Oberflächenfarben*), (3) transparent plane colors (*durchsichtige Flächen*), (4) bulky colors (*Raumfarben*), (5) mirrored colors (*gespiegelte Farben*), (6) lustre (*Glanz*), (7) luminosity (*Leuchten*), and (8) glow (*Glühen*). Film colors, surface colors, and bulky colors are the most important, because all other modes of appearance may be regarded as forms or combinations of these.⁴

In comparing surfaces and films, Katz takes paper as a typical example of surface, and the colors seen in a spectroscope as a typical example of film, although many other examples are also given. The observable differences between film colors and surface colors he groups under five headings: localization, texture, orientation, configuration, and aesthetic effect.⁵

1. *Localization*. "The spectral color of the usual apparatus is not localized with the same definiteness at a precisely determinable distance from the observer as the color of the paper." In saying that the film color is indefinitely localized, Katz does not mean that its distance varies from moment to moment. He says emphatically that, whether the observation is continuous or recurrent, with constant *Einstellung* of the eyes the distance of the color in no way changes. By indefinite localization he means positively indeterminate. It is true that probable limits may be set; but these limits vary with the *perceptive* conditions under which the film color is seen. For example, the limits lie much farther apart for the film of the sky than for that of the color seen in the spectroscope. Within these extraneous limits, the localization is positively indeterminate.

2. *Texture*. There is a baffling contradiction about the appearance of the film color. It seems to suggest depth, but proves in fact to be impenetrable. "The paper has a surface in which its color lies. The plane in which the spectral color stretches through space before the observer does not possess a surface in the same sense."⁶ One almost feels able to penetrate more or less deeply into the spectral color, whereas with the color of paper the gaze is forced to stop at the surface. The openness, the softness, the insubstantiality which the spectral color betrays is, however, not of such a kind that one can speak of a clearly bulky mode of appearance of the spectral color, that is, of a visible filling of space in three dimensions, or of any sort of colored transparency. Like the color of paper, the spectral color is bidimensional and screens the space behind from view.

3. *Orientation*. There is a marked difference in the orientation of the two types of color. The surface in which the color of an object, such as paper, seems to lie can take any orientation to the line of regard. The film color tends always to assume a frontal-parallel position. Indirect vision of course constitutes an exception to this rule, and there are certain other exceptions. For example, the apparent orientation of film colors is greatly influenced by the orientation of neighboring objects of *perception*. Katz describes an experimental arrangement whereby a bit of the sky, viewed through a cardboard tipped at an angle, takes on an apparent

³We could find no entirely satisfactory term for the appearance of the "completely reduced" color. Katz' word, *Fläche*, does not suggest an English equivalent. After trial of several words and after consultation with our Os we decided upon the term "film." Our "film," however, as is shown in the text, is not absolutely identical with Katz' *Fläche*.

⁴*Ibid.*, 6.

⁵*Ibid.*, 7.

⁶*Ibid.*, 7.

orientation about midway between that of the cardboard and the usual frontal-parallel position.⁷ In spite of such susceptibility to secondary influences, the film color possesses in and of itself a tendency to appear in frontal-parallel orientation.

4. *Configuration.* The surface of a body may be either smooth or ridged and curved in various ways. The film color on the contrary always lies in a practically smooth flat plane.⁸

5. *Aesthetic Effect.* The spectral color has something delicate about it, something more pleasing aesthetically, than the color of paper.—

This completes Katz' list of differences between film colors and surface colors. In connection with the third difference, that of orientation, Katz discusses, however, another difference, which he seems to regard as more fundamental than any of these five. Surface colors not only conform to the surfaces of objects, but they seem also actually to be stable properties of the objects. We can shadow or illuminate one and the same surface. A shadowed or illuminated film, however, is simply a new film color. Surface colors are color-qualities of objects. Film colors are unREFERRED colors, colors as such.

"So far as the psychological conditions are concerned, the consciousness of having an object before one on which the colors arise is for the perception of surface colors, I venture to say, of decisive significance. As compared with the great influence which the inner *Einstellung* exerts on the occurrence of this or that mode of appearance of colors, one may designate as almost irrelevant the physical source of the radiation setting up the impression."⁹

The relations between film colors and surface colors can easily be studied in the laboratory, because any sort of surface color can be reduced to film color by the use of a screen with a small hole, or (still better) of a double-screen.¹⁰ The exact form of double screen is not important provided the following essential conditions are satisfied. (1) The screen must cover the object completely except for the part seen through the opening. (2) At the same time it must not permit any structure or grain that may possibly be present to be recognized. (3) It must not permit any non-frontal orientation of the portion of surface seen to be recognized. (4) The hole must not be too large.

Between surface colors and film colors, all possible phenomenological transitions occur.¹¹ Many Os experience such a transition when monocular observation is substituted for the usual binocular vision. An intermediate which approaches more nearly to the true film can be secured by placing before the eye a lens too strong to be overcome by accommodation.—

The third of the essential modes of appearance of colors is that of the bulky colors. These differ from film and surface alike in that they are tridimensional and partially transparent. They seem to fill a *definite space* in its three dimensions. "According to my observation," says Katz, "they show this property in a distinct way only when they are at the same time in a true sense transparent," that is, so long as objects are actually seen through them.¹² When no object can be distinguished through the color, Katz would call it a film color.

Bulky colors, like surface colors, can be reduced to film colors. For this reason, Katz considers the film as the original mode of appearance of colors, and regards all other modes as derived from the film.

⁷*Ibid.*, 75.

⁸*Ibid.*, 12.

⁹*Ibid.*, 9.

¹⁰*Ibid.*, 9 f.

¹¹*Ibid.*, 9.

¹²*Ibid.*, 17.

The upshot of Katz' whole discussion is, evidently, that the film represents the ultimate stuff of vision. Color or light in the psychological sense is filmy. If we assume with Katz that the film is preperceptive, it follows that localization, orientation, and configuration cannot be attributed to it as such, and appear under experimental conditions only because and in so far as secondary perceptive conditions are introduced by the experimental arrangement. Going beyond Katz' empirical statements, we might lay down the following laws. (1) The film is not localizable. If it is localized, that is merely because, *e. g.*, we are familiar with the instrument through which we are observing. (2) The film has no orientation. If it appears always in a frontal-parallel relation to us that is simply because, in making it an object of observation, we give it the easiest and most obvious orientation; hang it, so to speak, on or across the line of regard. (3) The film has no configuration. As sheer sensory quality, it must show as a plane of homogeneous color.

Before the psychological status of the film is fully established, these statements must be confirmed experimentally by other *Os*. Psychologists have perhaps tended to take Katz' statements to be systematic; they are, in fact, merely empirical. The reader of the introductory chapter can scarcely help noticing many apparent contradictions. If, *e. g.*, Katz is correct in assuming that the fundamental difference between surface and film colors is that surface colors are ascribed to objects and film colors are not, in what sense can he assert the existence of transitions between film and surface? Surely the source ascribed to the color either is or is not an object.

Our experimental series were directed toward answering the following questions: (1) Are there intermediates between film and surface? What is their phenomenology, and in what sense may they be regarded as intermediates? (2) Can it then be shown experimentally that the object-consciousness is sufficient of itself to ensure the perception of surface color? (3) If the film color really is the ultimate stuff of vision, what happens to it that changes it to surface color in the one case and to bulk in the other?

The *Os* were Dr. L. B. Hoisington (H), assistant professor of psychology; Dr. H. G. Bishop (Bi), instructor in psychology; Miss C. C. Braddock (Br) and Miss G. Adams (A), graduate students in psychology; and the writer (M). All had had training as *Os* in previous psychological investigations.

The apparatus used for reducing surface to film was a double screen, similar in essential details to that described by Katz. It consisted of two entirely separate screens, constructed as follows. To a wooden frame, 71 cm. x 56.5 cm., was tacked a sheet of heavy grey cardboard which approximately matched in brightness no. 10 of the Hering series of grey papers. In the cardboard was a circular hole, 25 cm. in diam., whose center was approximately 31.5 cm. from the bottom of the screen, 25 cm. from the top, and 35.5 cm. from each side. To the back of each screen was fastened a strip of wood so cut that it formed a slot into which could be dropped smaller sheets of the grey cardboard. In the center of these smaller screens was a hole. The holes varied from 2 cm. to 20 cm. by steps of 2 cm., and were numbered from 0 to 9. There was a pair of every size, one to fit each of the two members of the double screen. The back of each hole was ground down with emery paper to present a sharp, knife-like edge. When one of the small screens was fitted into the slot, the small hole was concentric with the large hole.

The experiments were performed in a dark room, approximately 6 x 2.5 m. It was lighted from above by three 'daylight' lamps, arranged in a single row along the middle of the ceiling. The table to which the apparatus was fastened was set up at the side of the room, almost exactly midway between two of the overhead lamps, so that the screens and the stimulus behind them received an almost equal amount of light from the two sides.

There was practically no brightness-contrast between the fore and back screens in these experiments. The screens, being entirely separate, could be set at any desired distance from each other, but in all regular series they were 25 cm. apart. Other distances which might be varied were the distance of the stimulus from the back screen and the distance of the *O* from the fore screen.

From a few preliminary trials it seemed probable that reduction is favored by increased distance of *O* from the fore screen and by increased distance of the stimulus from the back screen, just as it is favored by a relatively wide distance between the two screens themselves. In all regular series, the *O* sat at a distance of 1 m. from the fore screen. This position was kept constant by the use of a fixed headrest.

II. SURFACE TO FILM

Series I. Effect of Varying Size of Hole

Series I was originally planned to answer our first question: Are there intermediates between film and surface?

The colored stimuli were cloths stretched very smooth on wooden frames, and Milton Bradley papers pasted on sheets of stiff cardboard. These could be fastened by thumb-tacks to a wooden and cardboard frame, so that a quick and easy shift from one color to another was possible.

When viewed without the double screen, these colored stimuli were, of course, ordinary surfaces. When they were viewed through the very small holes, their appearance approximated in most respects to the film as described by Katz. There were certain differences, to be discussed in detail later, but these need not concern us here. It seemed plausible to suppose that by varying the size of the holes, we should find, somewhere between the largest holes, which gave surface, and the smallest, which gave an approximation to film, some of those intermediates to which Katz refers.

The surfaces, like the films to which they were to be reduced, were flat and possessed a frontal-parallel orientation. The criteria of the true film were assumed to be indefinite (*i.e.*, only secondarily motivated) localization; bidimensionality; loose, soft, insubstantial texture; and complete lack of objective reference. We purposely omitted aesthetic effect, because we could not agree with Katz in regarding this as an observable difference on the same level as the others. All *O*s, however, occasionally exclaimed at the beauty of the film colors, in spite of the fact that aesthetic effect was not mentioned in the instructions.

It will be remembered that Katz' *O*s fixated the edge of the hole in the back screen,¹³ because this fixation was most natural and convenient and was moreover adequate to the purposes of his experiments. Since, however, we were to ask for reports of localization and dimensionality, it seemed best to instruct the *O*s to fixate the color under observation.

¹³*Ibid.*, 38, 73, etc.

The original instructions for H and M read as follows. "After the usual 'Ready, Now' signal, a grey screen and a brown disc will be exposed for 3 sec. Fixate the center of the disc. Immediately after the exposure, characterize the disc as either (1) surface, or (2) film, or (3) intermediate. Then describe it in terms of texture, apparent localization, dimensionality, and objectivity, and any other striking characteristics. In subsequent exposures, it is unnecessary to repeat in detail items that remain the same as in the previous exposure. Report fully whatever changes." The instructions for the other Os were the same, except that they were not asked to report on more than *two* descriptive characters at a time. In addition to the typewritten instructions, the Os were given typewritten slips with the following definitions. " 'Intermediate' means like surface in some respects and like film in others. 'Objectivity' means attachment or reference to a particular object, such as a board, a piece of cloth, a piece of colored glass, etc. 'Localization' means position, either (1) before the screen, or (2) at the screen, or (3) behind the screen, with a rough estimate of distance in the first and third cases. 'Texture' means material nature or substantial character, as transparent, translucent, opaque, hard, soft, solid, etc. 'Dimensionality' means extension solely in two or definitely in three dimensions." The term "mixed" was soon substituted for "intermediate," because under the conditions of experimentation no true (psychological) intermediates between film and surface were found. Later the term "mixed" was also dropped. For greater clearness and freedom from suggestion the definitions of terms were also revised, to read as follows. " 'Objectivity' means the conscious reference of the observed color at the time of observation to some concrete thing. 'Localization' means a given position, whether constant or temporary, of the observed color in the third dimension of space. 'Texture' means material nature or substantial character of the observed color. 'Dimensionality' means extension of the observed color solely in two or definitely in three dimensions."

We at first attempted to tabulate the results as fast as they were secured, but soon found that their complexity made a tabular mode of arrangement practically impossible. We shall instead treat of the observed phenomena in groups. It will be noticed that there is considerable overlapping between the groups.

Group I. Surface Colors

The phenomenology of surface colors presented no real difficulties. The descriptions were simple, brief, and consistent.

Localization. Bi (9)¹⁴ "About a foot and a half behind the screen." A (7) "It looked about two or three feet from the screen." Br (8) "Localized at a slight distance behind the back screen." H (9) "Surface behind the screen at some distance, a meter or so." H (9) "About .5 m. behind back screen." M (7) "Surface, quite definitely localized behind the back screen, though I can't give the exact distance in feet and inches."

Objectivity. Bi (8) "I could make out the inequality of the cloth, the weave, the fabric." A (9) "Rough green cloth." Br (8) "More uniform than cloth, more like paper." H (7) "Fairly definite object, cloth, or paper, or almost anything with a grain to it." M (9) "Opaque soft cloth."

Texture. Bi (9) "Weave of cloth." A (8) "Rough. I can see ridges, very close together, blurred." Br (7) "Smooth shiny cloth with darkish

¹⁴Numbers in parentheses refer to the number of the hole used.

grain." H (9) "Coarse woven cloth, slightly fleeced, so that texture is just a little obscured. Solid. Opaque." M (7) "Solid, opaque, soft cloth with ridged weave."

Dimensionality. Surfaces were always reported as bidimensional.

Group II. Film Colors

The Os were unanimous in describing the film color as indefinitely localized; but as regards the stability of the localization of film colors we obtained results that at first seemed opposed to those of Katz. It will be remembered that he combats the contention of Hillebrand that indefinite localization involves shift of position,¹⁵ and asserts that the film color does not change its distance, although it is positively indefinite in localization. Hence we were surprised to get occasional results like the following.

H (3) "One can do stunts to those things, so far as localization is concerned. They are instable. One can read all kinds of meanings into them." H (2) "Localization is shifty. At first it seemed to fill all the space behind the screens; but I took a localization attitude later, and it was easy to throw the thing farther back." H (1) "Slightly shifting localization. I don't mean that at any time I could say just where it was, only that sometimes it seemed nearer and sometimes farther." H (4) "Localization tends to shift from at the screen to far behind." Br (4) "It lay behind the back screen, came forward a bit, and then seemed to shift up to the fore screen." Bi (5) "I'm not sure whether it was always in the same place or not. I think there was a little play back and front. Not much."

The opposition between these results and those of Katz was, however, apparent rather than real. Katz says that the localization of the film color is stable with *constant Einstellung of the eyes*. With a little more practice our Os soon discovered that the apparent shifts in localization were due to shifts in fixation. It will be remembered that the original instructions read "Fixate the center of the disc." These instructions in a sense demanded the impossible, because there was nothing there to fixate.

H (1) "When you try to fixate, you have just that meaning of looking for something you can't see. You tend to stare. The eyes are held at an immense strain." Bi (6) "Almost impossible to fixate the center of the disc. My accommodation is for two or three different places!"

In hunting as it were for a place to anchor, the fixation naturally shifted about, and the film color, having no localization of its own, followed the changes of convergence. It therefore seemed advisable to alter the instructions with respect to fixation to read: "Regard the white spot at the lefthand edge of the screen opening as a fixation point and begin every observation with your eyes directed to that. You need not, however, feel obliged to maintain this fixation throughout the period of exposure." Under these instructions the Os made more accurate reports of their fixation, and it was found that apparent shifts in the localization of the color were always correlated with shifts of fixation.

¹⁵*Ibid.*, 11.

Bi (7) "I can't tell where it is, unless I hunt for it by changing fixation. In that case, the film seems to be anywhere I look for it, so long as I'm looking behind the second screen." H (1) "If I look at the back screen, then the color is beyond it. There is no color between me and the fixated screen. If, however, I try to fixate the color, then it is absolutely not localized." Br (1) "It jerked forward two or three times and then back again. I think these were eye-movements." A (3) "Every time my fixation shifts, the color shifts farther away or closer. I don't know how far away it was. All I could tell was that it was shifting." H (3) "It doesn't change a bit so long as one holds fixation." M (1) "The whole thing is perfectly stable so long as fixation is held, but tends to shift with fixation." M (1) "Color might be either at the back screen or slightly in front of it, or almost any distance behind; not that it ever seemed to be precisely in any of these positions. It remained absolutely stable so long as fixation was held, but shifted with shifting fixation, in this sense, that when I looked for it in one place it always seemed to be somewhere else. I never saw it actually shift. I never saw it in motion."

In regard to the tendency of the unlocalised film color to link itself with perceptive experiences in the visual field, our results also agree with those of Katz.

H (1) "It's just out there, apparently localized only in connection with some other experience." H (1) "Meaning of forcing the gaze at nothing in particular. In that sense you may say that the thing is not localized at all. But even so, one must force the gaze beyond the second screen and that seems to carry the meaning that the color is beyond that. One can't focus the eyes at a point and say the color is there. In that sense the localization is absolutely indefinite." Bi (4) "When I fixate the edge of the disc, I can see that the brown is behind that edge somewhere. No front or back limit to the brown."

In certain preliminary experiments, in which we tried to determine what length of exposure was most convenient for observation, we found that this tendency of the film color to link itself to the nearest perceptive object, the screen, is enhanced by very brief exposure times.

H "With the shorter exposures, the tendency for the color to be linked up with the back screen is a little more pronounced. With the 1 sec. exposure, it became almost a part of the screen, only it had no definite surface, nor any objective reference; but it belonged to the same depth level."

Thus our results with regard to the localization of the film colors are in full agreement with those of Katz. This was not the case with dimensionality. The colors observed were not unequivocally bidimensional.

H (1) "Comes right up to the screen, but extends back indefinitely." H (2) "Depth, but not penetrable." Br (1 B)¹⁶ "I couldn't look through it. It wasn't gauzy, but it seemed to have a bulkiness about it. I shouldn't say definitely tridimensional. Indefinitely so." H (1) "Tridimensional?"

¹⁶Letters following the numbers in parentheses refer to the colored stimuli. When no letter appears, a dark brown rep was used as a stimulus. Other backgrounds used in experiments from which these introspections are quoted were bright green cheesecloth (G), red-orange cheesecloth (O), purple lawn (P), and light brown gingham (B).

Hard to say. It might have been an unlocalized bidimensional something. The fact of its not having a beginning is the reason for calling it tridimensional. It may be due precisely to the fact that it was not localized." H (1) "I fixated the white spot practically all through the exposure. Under those conditions, I should call the color bidimensional. At least I didn't see any tridimensionality." M (1) "Not definitely tridimensional nor definitely bidimensional. I should have been inclined to call it tridimensional, but could not do so, because it has neither front, back, nor middle. My reason for wanting to call it tridimensional is that it is not localized in a single plane; but calling it tridimensional would not really help because it is not localized in any bulk of space either." M (1) "Tridimensional in the sense that very dense fog and thick, non-transparent dust clouds are tridimensional. Certainly not tridimensional in the sense that fluids in bottles or masses of jelly or blocks of colored glass are tridimensional. The brown color here had no beginning and no ending in the third dimension." A (1P) "I think I'd call it three dimensions, but I'd have to stretch what I mean by that. It certainly is more than two dimensions." A (1P) "I wouldn't say it was definitely in three dimensions. It was very indefinite. It's different from what I'm in the habit of calling dimensions. Dimensions are usually either solid or they've got some boundary that's flat or that blocks the thing off in some way. This sticks out in front, but it sticks out in such a vague way. It's not solid, and it hasn't any boundary." Bi (oB) "Not sure about the dimensionality, beyond the fact that it was spread out." A (oG) "I can't localize it, and I can't tell about its dimensions either." H (1) "I don't know. It certainly both is and isn't tridimensional, if one can make any sense out of that. Bidimensional, I believe." H (1) "One is left with the meaning that you don't know whether the thing is tridimensional or not." H (1) "How in the world can you say anything about the dimensionality of a thing if you don't know where it is?" H (1) "Bidimensional. I believe that the difficulty with the dimensionality is one of localization primarily." M (1B) "Bidimensional in the sense of having no definite extent in the third dimension, but tridimensional in the sense of not being localized precisely in one plane."

From these and similar observations it would appear that the phenomena with which we were dealing were neither bidimensional nor tridimensional. They were merely extended, without dimensions in the geometrical sense. We might almost have anticipated this result. For, after all, dimensionality in that sense is already a *perceptive* character. If a color is localized in one plane we call it bidimensional; if it is localized in more than one plane, we call it tridimensional; but if it is not localized at all, on what basis can we call it either? In describing the color as bidimensional, the *Os* had reference to its smoothness and impenetrability; in describing it as tridimensional, they had reference to its softness, looseness, and "invitation to penetrate." In either case, what the *Os* were describing was not dimensionality proper, but the *predimensional* nature of visual quality. So in the light of our results it seems evident that the product of the "reduction" of surfaces cannot be called bidimensional in precisely the same sense that a surface color is bidimensional. The film is bidimensional in the negative sense, in that it is not yet positively tridimensional. It is also tridimensional in the negative sense, in that it is not yet positively bidimensional.

The question of objective reference gave no difficulty. All the *Os* reported that the pure film colors had absolutely no objective reference.

The film colors had very characteristic textures, but the *Os* found considerable difficulty in describing these except by the use of perceptive analogies.

A (1) "It's hazy, but not haze. In the woods where there's been a fire and smoke lies in a thin layer on the ground you'd have something like this." H (1) "Like something viscous or gelatinous, if you could see such a thing without a definite front face." H (3) "Haze, solid, translucent, tri-dimensional,—like colored glass,—and yet, no! No analogy under the sun is exactly correct. The light is what bothers me. I don't see light through it nor light reflected from surface, nor is the thing especially luminous." Bi (oP) "It had a curious soft penetrableness." A (oG) "You wouldn't say it's luminous, but there's light in it in some way. It wasn't reflected from it." H (general observation) "The darker ones are always more like looking into a colored hole, whereas the brighter ones seem glowing." M (1) "Opaque in the sense of shutting off space behind, but not opaque in the way that a solid is opaque, for the shutting off did not occur at any particular place. I could look into the color, but not through it." M (1) "It was not opaque as solids are opaque. Yet it could not in any sense be seen through. The meaning of penetrability seems to be associated with the effort to gauge localization." Bi (5 O) "Self-radiant, somehow. I'm sure that if I didn't force it down by careful fixation it would be a tremendously glowing color. It's something like the glare we get at night when we approach automobile lights. It has the same beaming, dense character." Bi (3) "Haze points too much toward fogginess. This is beautifully clear. This is too dense for thin smoke. . . . It's like looking into a window from a lighted room into the dark. The dark comes clear up to the window, but you don't know where it leaves off. Same kind of thing here exactly." Bi (2) "No texture in the usual sense. Foglike, but not so dense as fog. Localization is uncertain. It seemed to stand behind the hole in space. There is a penetrability about a fog that this does not have." H (1 O) "I don't know whether it's translucent or not. It's something like translucent. Rather like dense gas, though not exactly like any I've ever seen." H (oP) "It's just a patch of color that isn't objective, and yet one tries to apply textural terms to it. If you have a texture, it must be a texture of something."

While in general there is no harm in saying that the tissue of the film color is soft and insubstantial, our reports indicate very clearly that the film is *pretextural* in the same sense in which it is predimensional. Texture is a perceptive character, and therefore cannot in its ordinary sense be attributed to a sensory quality. Texture, like dimensionality, seems thus to be bound up in some way with fixation.

H (3) "It's easy for that to be two different things: (1) a transparent (I don't like the word glassy) thing that becomes gradually less translucent, and then gets so dense that you can't see any farther into it. The thing shifts from that to (2) something at or almost on the screen, lustrous, almost luminous. I have never seen anything like it. I'm certain these two things depend on a shift of fixation."

Intermediates

No true psychological intermediates were found, under the experimental conditions of this series. With the holes inter-

mediate in size between those giving ordinary surface and those giving pure film, we obtained appearances that involved both simultaneously. These were usually described as a surface, seen more or less obscurely, and more or less definitely localized behind a semi-transparent medium of the same color. Similar appearances were frequently obtained with holes that at other times under precisely the same external conditions gave ordinary surface on the one hand, or pure film on the other.

The phenomenological intermediates found with different colored stimuli and various sizes of holes differed in the localization and texture of the surfaces and in the depth and density of the obscuring media. Strictly speaking, they did not fall into sharply defined classes. For convenience, however, we have classified the results more or less arbitrarily into four fairly distinct groups. Starting with surface as given, we have the following.

Group A. Soft Surface

Br (5) "More like surface than anything else, a surface that is a little thick; like a woolly surface, loose-woven so that you can look into it; like thick, blanket cloth." M (9B) "Cloth. Bidimensional. Definitely localized behind screen at uncertain distance. Very soft, velvety surface." H (7) "Solid without being highly resistant, like cut liver. Velvety comes nearest, but—! Something that by vision shows it is soft to touch. Bidimensional with a hint of tridimensionality." A (7) "Like a woolen sweater or a chinchilla coat or soft snow." Bi (9) "Nearly surface. The color is one foot or more behind the screen. Surface is irregular mottling of color."

Group B. Veiled Surface

Br (8) "Surface with a slight film over it." Bi (7) "Surface, 1 ft. behind screen. Out in front there was a little bit of brown haze." Br (8) "I don't know where the front or back of the film lies, but I do know where the surface component is." A (6) "As if you had a surface color and a haze in front of it." M (7) "Plainly cloth, not quite definitely localized. Suggestion of very thin, indefinitely localized film of brown haze somewhere in front, perhaps contiguous with the surface, perhaps detached from it. The cloth itself appears velvety, *i. e.*, the color is not localized in one plane, and still less is there any distinction of localization of separate threads to form a clean-cut cloth texture." H (7) "Very thin cloud or gauze before a solid, opaque, slightly irregular surface."

Group C. Fogged Surface

M (6) "Smooth, stony surface. It might be cardboard, stone, wall-paper, or cloth. The brightness pattern suggests cloth, but the surface appears too smooth; or rather, it lacks the definite distinction of localization of separate threads, which is characteristic of cloth. The surface as a whole is not quite certainly localized, and appears to lie behind a medium which is brown but nearly transparent, and is of indefinite depth and uncertain localization." Br (6) "Sort of brownish haze, looking back onto surface. Surface hard to distinguish." Bi (6) "I felt as if I could make out a little of the fleckiness of the cloth. Hazy foreground of color, as if at the back limit of it there was a surface; rather definitely localized. Localization of the haze is uncertain. All this is somewhere behind the back screen." H (5) "A surface, adhering to an object, and then something

else in front, just as one might see through a vaporous film. The tridimensional seemed set off from the bidimensional objective. The surface was localized at about 25 cm. behind the screen." A (6) "It looks like a surface behind, and thick haze in front. The surface looks like soft cloth."

Group D. Immersed Surface

M (4) "A surface, or at least something opaque, behind a medium of decreasing transparency. The medium began at or close behind the screen, and extended to the unidentified object, which was rather doubtfully localized, somewhere between 10 and 20 cm. behind the back screen." M (2) "Very indefinitely objective. Close behind the screen, not beginning in any definite plane, was a vaporous brown color, very dense and very still, almost so dense as to suggest a viscous liquid. This vapor was nearly transparent where it began, but became progressively less so farther back. Behind it at an indefinite distance, not very far, however, was a gelatinous or perhaps solid something whose texture was completely obscured by the medium in front." A (6) "Something with a haze in front of it. Too rough to call it surface, *i. e.*, not smooth enough across." Br (2) "More haze than surface. It stops somewhere indefinite." Bi (5) "Haze seemed to end in a surface, but I didn't see the surface, either." H (4) "Solid and opaque behind, but with a gradual transition through cloudy to a thin, feathery gauze, and to a vaporous almost-transparency. Tridimensional with a hint of surface at the back. The haze obscures too much to allow objective reference."

It is clear that what we have phenomenologically before us, in this series of observations, is the gradual break-down of a visual object. We begin with the colored surface of a determinate thing, and we end with a sheer quality of color that is not the color of anything. Phenomenologically, we agree with Katz, the transition is continuous. The object of which the color is the surface becomes more and more vague, indefinite, unrecognizable, until only a vestige of objective surface, a hint of the surface of an indeterminate something, is left; and finally this last vestige of objectivity itself disappears.¹⁷

Psychologically, however, the picture is very different. At first we have the fairly simple perception of the surface of a material object;¹⁸ this perception grows more complex, as the surface recedes and the haze before it becomes prominent; in the stage which we have distinguished as Group D the percep-

¹⁷It was probably one of these intermediates, and not the film proper' that was perceived by the patients of Gelb and Goldstein. See K. Goldstein und A. Gelb, *Psychologische Analysen hirnpathologischer Fälle auf Grund von Untersuchungen Hirnverletzter: IV. A. Gelb, Ueber den Wegfall der Wahrnehmung von Oberflächenfarben*, *Zts. f. Psych.*, 84, 1920, 193-257.

¹⁸'Surface' is such a visual space-phenomenon as it has been worth while to name, and therefore to make into a formal, text-book 'perception'. If any of the other phenomena here noticed corresponded regularly with our modes of apprehension of the outside world; if, that is to say, veiled, or fogged, or immersed surfaces were part of our everyday experience; then they, too, would have been listed as definite 'perceptions'. They are, however, so uncommon that they have not been identified or stabilized by name.

tion is at the height of its complexity: we have the vestige of a surface, covered by a haze which is denser in its remote portion and becomes clearer as it extends nearer to us; and in the next following stage, that of the film proper, we have (with the disappearance of the last remnant of surface-color) no perceptive object at all, but a sensory datum, ultimate and unanalysable. If we persist in taking up toward this datum the perceptive attitude which we have maintained throughout the series, we are obliged to characterize the 'object' by negatives: it is not now localizable, it is not dimensional, it is not objective. There is, then a continuous increase of psychological complexity up to (and including) Group D, and then there is a sudden break, from 'perception' to 'sensation,' from highly complex to absolutely simple.

If we may trust the reports of the *O*s, the determining factor throughout this experiment is *localization*, and the phenomenological continuity of the series depends upon the steadily increasing difficulty of localization as cleancut surface is left and film is approached. The following reports are typical.

Bi (2 G) "When I get my fixation on the cloth, it flattens right out. Localization is definite. It's hard to keep it that way. It will cloud right up and be a disembodied green." Bi (3 G) "The color fogged up as I ran my eyes back, but as soon as I got definite localization there was nothing but surface, bidimensional and definitely localized." Bi (o G) "The filmness and localization vary with fixation." Bi (3) "That film is determined as much by fixation as by the screens. I've got more or less at the same exposure from the same screen." H (o P) "That thing comes so near to being nowhere that it's almost nothing." A (o P) "I believe if I could definitely localize how far away it was, I could get it as a surface, and the thing works both ways." Br (9) "I can get a surface or a film either one, depending on where I focus." Br (3) "Film at first. Then surface. These are changes in convergence, I'm sure." H (1 G) "I can fixate that so that it becomes just a cloth surface. My eyes water and ache. When I do fixate it, it is localized fairly definitely behind the second screen, 15 or 20 cm." Bi (5 G) "Fixation would slip and film would form. Then I would get fixation and film would disappear."

Summary: Effect of Size of Hole

In reporting the results of this Series I, we have given the size of the hole in connection with every introspection quoted. There was much variation (both from *O* to *O*, and with the same *O* at different times) so far as the exact size of hole is concerned at which the various modes of appearance were reported; there was, on the other hand, great constancy in the descriptions.

Films were reported most frequently by all *O*s with holes o and 1 (2 and 4 cm. diam.). H and Br occasionally reported film with holes of other sizes, up to 14 cm. diam. The film-reports with the larger holes came in the early stages of practice.

Surfaces were most frequently reported by all *O*s for the largest opening (20 cm. diam.). With the cloths of very open weave, especially the green and orange cheesecloths, surface was often reported with smaller holes.

The *intermediates* showed a good deal of overlapping. The medians (all Os) were: soft surface, 18 cm.; veiled surface, 14 cm.; fogged surface, 10 cm.; immersed surface, 8 cm.

Series II. Effect of Localization

From the results of Series I it seemed probable that with our experimental arrangement the essential condition for the appearance of surface on the one hand or of film on the other is the localization or non-localization of the color quality. If this inference proves true, we have already answered half of our third question. We have found what changes the sheer color quality into the color of something. We should now be able, therefore, to change film colors to surface colors by giving the stimuli a definite localization. In Series II we attempted to test this hypothesis by bringing a strong localization-motive to bear upon what had been reported as a film color.

The colored stimuli used were Milton Bradley colored papers and the dark brown rep, because in the preceding series these had given pure film colors with larger holes than had any of the others. The most natural and obvious cue to localization was a fixation point in the center of the color-field viewed through the double screen.

We used both black and colored fixation points. They were cut with a beveled circular punch and were slightly more than 1 cm. in diam. The usual exposure time in this series was 5 sec. Longer and shorter times were tried without affecting the results, except when prolonged fixation was accompanied by staring. The following instruction was given. "After the usual 'Ready, Now' signal, a colored disc and a differently colored fixation spot will be exposed. Be sure to maintain fixation at the fixation spot. Report on the character of the spot and of the colored field in terms of localization, dimensionality, texture, and objectivity."

At first the Os had great difficulty in fixating the point, because the edge of the back screen offered rival fixation points. When they had learned to maintain fixation upon the spot, the color was almost always seen as surface. This procedure was possible for all except the 2 cm. hole, which did not permit of binocular fixation of the fixation spot.

A (2 BL, o)¹⁹ "Behind the back screen several inches. Small round piece of orange paper placed on top of a piece of blue paper." M (1 D, bk) "Cloth with a black spot on it. Very definitely localized. Texture and weave very plain." H (3 D, bk) "If I attempt to fixate the color beside the spot, it is possible to make the color a surface in a plane with the spot." H (2 BL, o) "When I first looked at that, I was sure it was simply one bit of paper on another. Definitely surface behind the screen, opaque and

¹⁹The large letters after the figure in parentheses indicate the background; the small letters, the color of the fixation point. The backgrounds used in experiments from which these introspections are quoted were dark brown rep (D), and the following Milton Bradley colored papers: blue green (BG), dark blue (BL), and red (R). The fixation points were orange (o), yellow (y) and black (bk). Many other combinations were of course tried. The colors used did not affect the results at all.

solid." Br (2 R, bk) "A bit of red paper with the black stuck on it." Bi (1 R, bk) "I saw the spot pasted on in front. Both the purple and the spot were surface colors."

The spot and the color nearly always appeared as surface at first. Sometimes under steady fixation, even with the 5 sec. exposures, they took on a filmy appearance.

Br (2 R, y) "Yellow circle on a red background, which seemed at first to be surface; but as I looked, that seemed to be red air or space, not filmy enough for air. Momentarily it looked as if the yellow were in front of it, floating." H (2 BL, o) "Orange surface, bidimensional, definitely 15 cm. behind the screen. Definitely paper. The blue was simply some kind of blue surface. It might have been anything opaque and solid. As I stared at the orange spot, the blue became indefinitely localized, except that it dropped behind the orange."

In spite of these complications, we had shown conclusively that a visual cue to fixation was sufficient to change to surface an appearance which would otherwise have been filmy. This result in isolation would have been equivocal, however, because a bicolored film might perhaps be a visual impossibility. We therefore decided to see whether the cue to localization might not just as well come from some other sense department. The sense departments chosen for experiment were the tactual-auditory and the auditory.

In the lower part of each member of the double screen and also of the cardboard to which was pasted the colored stimulus were cut small holes 2.5 cm. square. A long rod passed freely through these holes. A piece of cardboard could be set up either against the color screen or in front of it in any desired position. O was allowed to feel through the screens with the rod until the tip of it touched the cardboard and then to tap, while looking at the colored field. Before the stimulus color was actually exposed, E put the pointer through the double screen in position for the tapping. Then the color was exposed for 5 sec., during which time O tapped the cardboard and looked at the color.

At first the Os found it impossible to connect the surface felt with the color seen.

A (2 BL, poking) "I don't think I'm realizing very well that I'm poking the identical thing. That's a hard thing to do. I'm looking at this thing up there and poking this thing down here, and there's no connection between them." Br (1 BL, poking color screen) "I can't think of those two as being the same. It was surface I was touching back there, but it didn't look and feel the same." M (2 BG, poking color screen) "The object poked seems to have no relation to the color." H (2 BL, poking in front of color screen) "Curious feeling of the unrelatedness of the two things. The things simply don't belong together. I certainly was not poking at the color; for the most part behind it. The color is not at the screen. It is unrelated to the screen, but doesn't seem very far beyond it. One would be perfectly willing to grant that it *might* be twenty feet beyond. For the most part I was punching behind where the color lay." Bi (2 BL, poking) "I don't see any point to sticking this pointer down there. I see color up here in this position and away off in some other universe I stick this thing through. I see the color and the color is nearer than the pointer."

After about six hours' practice, however, the color, which had appeared filmy, could be transformed to surface by the tapping, though it was rarely possible to hold the surface throughout the period of exposure.

Bi (2 BL, poking) "Sometimes while I was localizing the tip of the pointer, I seemed to see a surface." Bi (2 BL, poking) "If I turn my attention away from the color and think where that pointer is, I can see the color as blue paper." Br (1 BL, poking color screen) "At first they seemed quite incompatible, and then the blue receded backwards while I poked and became for a moment surface lying some distance behind the hole, but I couldn't continue seeing it that way." Br (1 BG, poking) "At one of the pokes, the color receded and became a flat surface and the tip of the pointer was touching the same surface." H (2 BL, poking color screen) "If I attend very closely to the sensations (both tactual and auditory) that come from the punching, then the thing does change. I'm not sure just what happens. The color does get thrown back there and fairly definitely localized, pretty definitely bidimensional. It certainly becomes more like an object, though just what I couldn't say; more like a smooth, painted surface, fairly opaque." H (1 BL, poking in front of color screen) "If I definitely focus at some distant point, although I can't see the point,—but yet I have this tactual cue that helps me to establish and hold it,—then the color seems to retreat and become very suggestive of a surface." H (1 BL, poking in front of color screen) "I then attended to the punching and tried to fixate a plane perpendicular to the end of the stick. At first the color was indefinite in localization but, as fixation steadied, there was a sudden shift of that color. It seemed to start to retreat, and then became very suggestive of a surface perfectly stable in localization for a second or two." A (2 BL, poking and told to concentrate attention on the poking) "It seems every now and then that I just poke a flat surface, and it looks like a flat surface." A (2 BL, poking) "It's hard for me to think that I'm poking the same thing that I see, but when I do get that realized, all of a sudden, just in a flash like that, it's a surface behind the screen."

In this experiment the cues to localization were both tactual and auditory. The *Os* were guided not only by sensations in the hand and arm, but also by sounds produced when the rod struck the cardboard. It therefore seemed advisable to see whether sound alone was an adequate cue to the change of film to surface.

Immediately after the color had been exposed, *E* tapped without jar, either on the back of the cardboard to which the color was pasted, or else on another piece of cardboard of the same kind, held in the hand before or behind the colored stimulus. The taps were mostly given in pairs, with an interval of 0.5 sec. between the two taps of each pair and an interval of 2 sec. between pairs. The length of the exposure varied with the number of taps given. The usual number was 5 pairs, requiring an exposure time of 15 sec. The total exposure time seemed to make no difference to the general results.

At first, again, the *Os* found it impossible to link up the sound and the color. The two experiences seemed to be disparate and unrelated.

Br (1 BG, tap 2)²⁰ "All I can say is that I couldn't bring the two ideas together. The color is much nearer than the sound. The hollowness of the sound gave an idea of solidity, which was not borne out by the flimsiness of the color. The sound was from cardboard, distinctly objective." A (2 BL, tap 10, in front of color screen) "I can't realize that it's the same thing. Seems as if you're tapping behind the color. Your tapping doesn't affect the color. I'm looking at the color, and you're tapping away off, but they have no connection for me. I can't get them connected." Br (1 BG, tap 2) "No realization. I saw the color as nearer than the sound." Bi (1 R, tap 10) "The auditory localization is very complicated. I'm afraid I'm paying too much attention to auditory localization and not realizing that the sound comes from the colored stimulus." H (1 BG, tap 1) "No change. I never localized the tap so far as fixation was concerned." H (1 BG, tap 10, in front of color screen) "I didn't succeed in bringing the tapping and the color into relation." A (1 BG, tap 10) "The color is in the focus of attention all the time, and I hear the tapping as an incidental noise."

Again, however, when the Os had had five or six hours' practice in these auditory localizations, the colors were changed from film to surface as they had been by the other two methods.

H (2 BL, tap 10) "It's hard to fix the distance of those taps and hard to fixate the point with the eyes. However, there was some shift over to the surface thing, *i. e.*, it became definitely localized 20 cm. behind the back screen, and definitely bidimensional." H (1 BL, tap 10) "It shifted to surface with the first pair of taps. That was maintained till between the second and third pair. Then I went over into a stare, and the thing became pretty positively filmy. After the third tap, I shifted back to fixation of the place where the taps came from and it became definitely surface with lights and shades,²¹ and nearly papery." H (1 BL, tap 10) "I tried to fixate a point just behind the back screen, but this side of where the tapping took place. I maintained that till after the second pair of taps. It seemed to throw the color back a little, but otherwise it remained pretty good film. Then I fixated the point of tapping and got the surface thing." H (1 BG, tap 10, behind color screen) "The color tends to fluctuate between taps. The first pair of taps made no difference. With the second pair, the color definitely retreated. All of a sudden you find it back. You didn't see it go back. Bidimensional. About 20 cm. behind second screen. Certainly a surface, opaque and solid. . . . The transformation to surface always came with (or just following) the pair of taps." H (2 BL, tap 2) "After the second tap came a readjustment of fixation, and it became definitely surface." H (1 BG, tap 1) "It certainly does shift over to surface with steady fixation, when the eyes are set to fixate a point where the sound is localized. The shift came just after the tap, and then I tried to localize it in terms of the screen, but as soon as I tried to see where it was relative to the screen, it became cloud. Then when I returned to the fixation of the point tapped, it became surface again." Br (1 BG, tap 2) "Yes, they seemed to come from the same surface that time." A (1 BG, tap 10) "It seems that after I get fixed for realizing that back screen and I hear you strike it, I'm looking at the color and I'm conscious that it's there, but the

²⁰The figure after the word "tap" indicates the number of times that *E* tapped during the exposure preceding the report quoted; thus "tap 2" means that a single pair of taps was given.

²¹There were of course no lights and shades; yet the appearance of surface occasionally led to their report. So one *O* reported the weave of a cloth, when in fact he was looking at a disc of colored paper. He had, it is right to say, been observing cloths during several preceding experiments; and the phenomenon was evidently an ordinary tied image.

tapping is in the focus of attention. But then, after you've stopped tapping, the color gets into the focus of attention again. In that shift I see the color as back behind the back screen, in two dimensions, just a flash of it. Then it goes back to what it was before." A (1 R, tap 10) "I got a flash of it receding from the back screen and being a perfectly flat surface right after you tapped." Bi (2 BL, tap 10, in front of the color screen) "Once I saw a surface when you tapped. Then again I didn't. Then you tapped again, and I did see a surface. Between taps the color was filmy." Bi (1 BG, tap 10) "For the most part the color was in front of the tapping. Just once I seemed to get a fair surface. I think it came partly by way of fixation." M (2 BL, tap 10) "The color changes from film to surface with each pair of taps, but returns to film between pairs."

Thus by giving localization through three different sense departments we had changed to surface a color that would otherwise have been filmy. In all these experiments, therefore, we are referred, as we were in Series I., to the predominating influence of localization. We have been able to change a film color into the surface color of a determinate object by introducing motives to localization, and the result has been in principle the same, whether the motive was visual, auditory-tactual, or auditory.

Series III. Observations of Familiar Objects

Series III was designed to answer the second question proposed in our introduction: "Can it be shown experimentally that the object-consciousness is sufficient of itself to ensure the perception of surface color?" If this were so, the knowledge that one is really looking at a familiar object should enable—nay, even compel—one to see surface, and prevent the reduction of surface to film.

Two forms of double screen were used, one of which was identical in essential details with that previously described, except that a single-sized opening of 9 cm. diam. was used. *O* sat at distances of 1.5, 1, and 0.5 m. from the front screen. No head rest was used. *O* could move the head and eyes freely. No instructions were given with regard to fixation. Most of the *Os* found it easiest to fixate on the edge of the hole in the back screen.²²

The stimuli were familiar objects: a board, a fur neck-piece, a strip of felt, a satin cushion, a woolen sweater, aprons, coats, and cloaks. *E* placed the stimulus in such a position that it entirely filled the hole, and also projected above the upper edge of the double screen. In direct vision *O* could not have seen the stimulus above the screen and in the hole at the same time; but by slight movements of the head and eyes it was possible to make swift comparisons of the two. Under these conditions, the *Os* never described the color in the hole as ordinary surface color, except when they also reported some detail of structure which offered a fixation point.

²²Katz, *op. cit.*, 38.

The other form of double screen was used only in this series. It was designed to compel parallel vision.

Like the regular form, it was made of grey cardboard fastened to wooden frames. In each screen were cut two holes of 1.5 cm. diam. The wooden frames carrying the cardboard screens were then clamped at the front of a table, and *O* sat as close as possible and looked directly into the front screen, as into a binocular telescope. Since the interocular distance differed slightly for different *O*s, different double screens constructed on the same principle were used, and the precise distances between the holes were chosen empirically to suit the *O*s.

The stimuli were small familiar objects: soap, chocolate, paper, and the like. The stimulus was first handed to *O*, and he was allowed to examine it as he pleased. Then *E* placed it behind the double screen. *O* did not know how far from the double screen the object was to be placed. With this exception, the *O*s worked with full knowledge of the apparatus and manipulations. They therefore had "the consciousness of an object upon which the colors arise," which Katz regards as the essential condition for perceiving surface. Yet, under the above conditions of experimentation, surface colors were never reported.

III. BULK TO FILM

Series IV. Episcotister Before Surface With Fixation Point

We planned Series IV as a direct parallel to Series I. We intended, that is, to begin with a positively bulky color, and to carry this over by intermediates, phenomenological or psychological as the case might be, to film color. Bulky colors were secured without the use of actually bulky stimuli by means of colored episcotisters.²³ When an object is seen through a rapidly rotating episcotister, it appears as if seen through a haze of color. Under certain conditions, this haze expands to a positive bulk.

The episcotister used in these experiments was made in two identical parts, each of which was constructed from a disc of thin but very stiff cardboard, 51 cm. in diam., by cutting out 6 sectors of 30° each, leaving 6 equally spaced sectors of 30° each. These were covered on the one side with blue paper and on the other with reddish orange paper. These two colors were chosen for convenience. Any other colors might have been used. In cutting out the sectors a cardboard margin, 2 cm. wide, was left on the outer edge, and a cardboard disc, 12.5 cm. in diam. at the center for support. The episcotister was mounted on an electric motor, operated by pedal. By proper combination of the two pieces, it was easy to use any amount of color from 180°, which gave a slight, vague, barely perceptible haze in front of the background, to 360°, which of course was no longer an episcotister, but a solid color disk. It was possible to use either pure blue or pure red-orange or any desired mixture of the two colors, by using the blue side of the one disc and the red-orange side of the other. Other differences in color could be obtained by varying the color of the background. The backgrounds used were whole sheets of Milton Bradley colored papers tacked to the wall of the dark room. The table, carrying the double-screen and the episcotister, was so placed that the back screen was 65 cm. from

²³*Ibid.*, 310.

the colored background. The episcotister could be moved to any desired position between the screen and the background. The exact position seemed, so far as our results were concerned, to make no difference. Distances actually used were 10, 15, 20, 25, 30, 35, 40, 45, and 50 cm. from the back screen. Even with the two extremes, no consistent difference in reports could be discovered. As one O remarked: "I don't seem to get any variation in the experience, however you move things behind." In the latter part of the series, the distance between the episcotister and the back screen was kept at 20 cm.

The Os were given typewritten instructions, similar to those used in preceding series. The exposure time was 5 sec.

Under these conditions, with screen 3 (8 cm. hole) appearances precisely similar to those of Groups B, C, D of Series I were secured,²⁴ an increase in the amount of color in the episcotister having precisely the same effect as the substitution of smaller holes had had in the series without fixation points. A further increase in color, however, did not result in the immediate appearance of film, as it should have done on the analogy of Series I. Two other stages, which we have designated as e and f respectively, were found. In Group e, the last vestige of surface is gone, and the fixation point, whose contours are by this time badly blurred, is seen floating deep in a thick substantial mist.

Bi (3 O, bk, 336 O)²⁵ "The film is well this side of the fixation point and definitely behind the screen. It hints at dimensionality. The surface has been out for quite a while. I didn't realize it was gone." Bi (3 O, bk, 330 O) "Now the fixation point is away back in a dense tridimensional orange. It might be daubed on the back of it for all I could tell, only the film wouldn't support an object." H (3 O, bk, 240 O) "Uncertain localization. Curiously, the spot seems to be behind the screen. The color might be this side of the spot. The color seemed more indefinite than the spot. Very fuzzy, felty, soft. No particular objective reference. Cloudy. Translucency is suggested." H (3 O, bk, 330 O) "The spot always seems to be back in the color, like something indistinctly seen through haze. The haze is simply out there, and that is all you can say. The haze is around the spot and in front at the same time." Br (3 O, bk, 330 O) "Fairly dense haze. The fixation point is floating somewhere in the haze. The position of the whole thing seems moved toward the hole, but not as far back as when seen on the surface." Br (3 O, bk, 336 O) "The haze was still denser. The fixation point came and went. Very indistinct. It might be located anywhere within the haze." Br (3 BL, bk, 270 BL) "The dense haze fills all the space up to the hole. The spot is somewhere behind that blue haze or immersed in it, so that you can see the blue in front of it." A (3 BL, bk, 342 BL) "Dark blue mist. I could see the fixation point through it a good way back. I couldn't see any surface." A (3 O, bk, 339 O) "I looked into an orange mist that came up to the back screen, and far back in the mist I could see the fixation point very vaguely. I don't think the mist looked as if it went farther back than the fixation point, but I'm not certain." A (3 O, bk, 348 O) "Looking into orange mist. It came up to the

²⁴For facility in cross comparison, we shall continue to refer to these by the same letters as in Series I, but shall use small letters instead of capitals, so that the two series may be kept distinct.

²⁵The second number in the parentheses indicates the number of degrees of color in the episcotister; the letter following it, the color used on the episcotister.

back screen, and I don't know how far it extended; not very far. Fiery kind of mist. It looked as if it might have been made up of thousands of little particles. I could make out the fixation point, somewhere in the mist. Its outline wasn't distinct." M (3 BL, bk, 210 O) "Fixation point barely visible through a dull pink tridimensional haze. The fixation point is indefinitely objective and bidimensional."

In Group f, the fixation point is no longer an object, localized with difficulty in the midst of a thick haze. It has become a film, as positively indefinite in localization as the color around it, which approximates the films obtained by the reduction of surfaces, the only difference being that it is slightly more suggestive of tridimensionality.

H (3 BL, bk, 180 BL) "At first glance it's the old indefinite cloudy thing. Then I got my fixation point, but couldn't hold it. There was a good deal of fluctuation. Localization was not very certain, but there was a tendency to put it behind the back screen. Bidimensional, but might easily have been tridimensional. No objective reference. Strong hint of translucency, but yet I couldn't actually say that I saw into it; more of the cloudlike effect. The fixation point shared the character of the color." H (3 BL, bk, 300 BL) "I saw the fixation point dimly all the time. No difference between the spot and the blue. Indefinite localization. Strong hint of tridimensionality. Strong hint of translucency, and yet I couldn't see into it. For the most part I haven't been able to focus on the fixation point." Br (3 O, bk, 330 O) "I saw the fixation point as a very faint grey filmy spot, not flat. It had a film in front." Br (3 O, bk, 342 O) "Film, perhaps a little denser. I see the fixation point as a grey nebulous mass in the center." Br (3 O, bk, 348 O) "Very dense film. Slight greyishness in the center. It didn't have any definite outlines, and didn't appear like a fixation point at all. Just a bit of grey film." A (3 O, bk, 339 O) "I could see the fixation point very vaguely. I don't think the mist went back any farther than the fixation point, but I'm not certain. I can't say whether the fixation point is standing out in the mist or whether it's behind it." M (3 BL, bk, 180 O & 150 BL) "The fixation point is barely visible in a mass of red fog, which is tridimensional. The fixation point is filmy, indefinitely localized and non-objective." Bi (6 BL, bk, 324 BL) "Fixation point is back again just a little. I can make it out with some certainty now, just a little dark spot. It's filmy, too." Bi (6 BL, bk, 327 BL) "Able to see the fixation point about a third of the time. It's also filmy." Bi (3 BL, bk, 180 O & 30 BL) "Fixation point and fixation screen are both films now, but not very far removed from surface. All the color is close together in a thick plane, no texture."

When the amount of color in the episotister was increased so much that the fixation point was no longer visible, the resulting appearance was a film, practically identical with the films found in Series I. One O called attention to this fact.

Bi (6 BL, bk, 330 BL) "Fixation point gone. It's a great film, filling up the whole area behind the cardboard screen. As far as I can tell it doesn't look any different from the plane colors of the other series."

Here, as in Series I, there were of course a few equivocal cases, which seemed to fall midway between two of our groups. The following may serve as examples of a suggested intermediate between e and f.

Br (3 O, bk, 180 BL & 150 O) "Pink film. The fixation point floats in the film. Fairly dense. Pinkish right up to the hole. The spot is filmy, but seems to lie right back in the film." H (3 BL, bk, 180 BL) "The fixa-

tion point was definitely localized at 30 cm. or more behind the screen, probably bidimensional. No objective reference. Opaque, solid. The color was different. I know little about the color. Not definitely localized except behind screen. So far as I can say, it was bidimensional. I don't know that I saw it dimensionally at all. No objective reference. Opaque; whether solid or not I don't know."

The dependence of all these appearances upon fixation is illustrated by many reports, of which the following may serve as examples.

A (3 BL, bk, 306 O) "The fixation point is back. I can't see it on a surface. When I see the fixation point, the mist extends lots farther back than when I don't see it." A (3 BL, bk, 312 O, immediately following the previous report) "At first I looked into orange mist, which had a little tinge of lavender, extending back an inch or so. Then I looked carefully and saw the fixation point, and the mist spread away back." Br (3 BL, bk, 300 BL) "No fixation point visible, just dense blue film. I can't see through it as far as when I looked through it to the fixation point." Br (3 BL, bk, 321 BL) "When my fixation comes front, the color becomes very dense and occupies all the space between my fixation and the screen; when I maintain fixation, I get what I described last time, *i. e.*, approximate surface behind at the fixation point, with dilute film out in front, which came toward the screen, but not to it. The surface was bidimensional; the rest, tridimensional." Bi (3 BL, bk, 324 BL) "No fixation point visible. I could make out an approximate surface back where the fixation point would have been if I could have seen it. The rest was thick haze, uncertainly localized." H (3 O, bk, 336 O) "If I look simply at the color I get it indefinitely localized, bidimensional, hinting at tridimensionality; sort of a rudimentary tridimensionality. No objective reference. Pretty much the cloud. A little hard, maybe. Hints at translucency. The spot is simpler a darker bit in the color. If I look for the spot, then I seem to be able to throw the spot back."

A short supplementary series was tried in which the background, instead of being a plain sheet of colored paper, was a sheet of cardboard bearing the printed symbols PSYCHOLOGY I B and a rough drawing of an arrow. Screen opening no. 3 was used, and the amount of color in the episcotister was varied from 180° to 330° by steps of 30° . The resulting appearances were surfaces obscured by hazy or bulky colors, which varied in depth and density according to the amount of color in the episcotister. The more color in the episcotister, the denser of course was the haze. The apparent depth or degree of tridimensionality increased up to about 270° and then diminished as more and more color was added. When the letters could no longer be seen the resulting appearance was the familiar film.

Series V. Episcotister Before Surface Without Fixation Point

Series V was undertaken as a forlorn hope to see whether our practised Os might possibly report the impression of bulky color, as in stage e of the preceding series, even though the fixation point had been removed. The arrangement, therefore, was identical with that of Series IV except that the colored backgrounds were uniform over their entire surface.

The attempt was partially successful. Usually, it is true, the reported color was almost identical with the films obtained from the reduction of surface colors; like other films, it was non-objective, unlocalized, and pretextural; but it often seemed to hint more strongly at tridimensionality; and sometimes tridimensionality of uncertain amount was positively ascribed to it.

Br (3 O, 180 O) "Red bulk rather than red film, like a red liquid." Br (3 O, 180 O) "Dense red film, redder than before. It's almost as if I were looking through a red light or into a brilliant flame. Luminosity." H (6 O, 180 O) "Too luminous for cloudy; too much like a glowing ember where you only see the glow. No other perceptive motive there. It tends toward a glassy or liquid bulk, though it isn't that." Bi (3 O, 270 O) "Thicker now and more nearly tridimensional than before." A (3 BL, 180 BL) "It comes up to the back screen and seems to come out just a little bit at the middle; just floats out like mist." H (3 O, 180 O) "Suggestion of tridimensionality. Hint of depth. Sometimes part of the field was almost bulky." H (3 O, 279 BL) "For the most part behind the screen, but not very definitely localized. Tridimensional for the most part. Translucent, like bulky liquid tending slightly toward gaseousness. It definitely had depth." M (3 O, 180 O) "Very dense haze. Comes up to the back screen and extends back a short distance." M (3 BL, 330 BL) "Stationary blue haze, doubtfully tridimensional, suggestion of translucency. Perhaps lighter in front and dark behind. Indefinitely localized."

Associated with the tendency toward bulkiness, the Ossometimes reported a sort of incomplete objectivity.

H (3 O, 180 BL) "For the most part tridimensional, although the tridimensionality increased and decreased, with a wavelike effect. Objective reference, but not specific. It didn't come as an object, but you could make it into an objective something."

Thus in Series V we seem to have found something like true psychological intermediates between film and bulk. Equivocal appearances tending more or less toward tridimensionality were reported from time to time throughout the series. Whereas, under conditions of binocular vision, film changes into surface at a single step by way of superadded localization, film seems to pass into bulk by insensible degrees, as if by mere extension of that suggested but unrealized tridimensionality which all Os, those of Katz as well as our own, have remarked.²⁶ We believe, nevertheless, that *these intermediates are still nothing more than phenomenological*. It must be remembered that the bulk in our bulk-to-film series was itself only generically objective, an affair of haze or mist in general, and not specifically objective like the surface color of paper or cloth; nor was the background so marked or shaped as to suggest a determinate object seen through an intervening haze; it was mere expanse of color with a central fixation point. Even in stage e, O may report entire lack of objective reference, especially at an early stage of training. Hence it is probable that we are here in presence of perceptive formations whose likeness to any common object of percep-

²⁶Katz, *op. cit.*, 7.

tion is markedly less than that in the formations named b, c, d. This conclusion is borne out by reports of vague or general objectivity, reports which increase in frequency as the training of the *Os* progresses.

For the reader's convenience we insert here a brief table of the phenomenological results of our two main Series.

SERIES I		SERIES IV
A	Soft surface	
B	Veiled surface	b
C	Fogged surface	c
D	Immersed surface	d
	Substantial haze	e
	Cloudy haze	f
	FILM	

A, B=b, C=c, D=d, and e are without doubt perceptive formations. We believe, as has been said above, that f is also psychologically a perception; in spite of the unfamiliarity of colored hazes in everyday life, the *Os* tended more and more, as observations went on, to report a vaguely objective reference. The fact, however, that any degree of doubt or hesitation can arise at this point supports our conclusion that the ultimate film is more suggestive of tridimensionality, less positively bidimensional, than Katz has made it.

In connection with these bulky hazes, a rather curious phenomenon seems worthy of remark. Some of the *Os*, most frequently Br, reported not only positive tridimensionality, but also differences of hue, between the front and back regions of the haze.²⁷

Br (6 R, 300 BL) "Dense blue film with the faintest tint of purplishness in the front and dense blue toward the back." Br (6 R, 270 BL) "Deep purple, pinkish toward the front. . . . In all these the film begins at the screen and goes back from there. Usually the front is filled in with a lighter film, misty." Br (3 YG, 180 BL) "Greenish film, whitish-yellowish at the front and green farther back. It starts at the back of the back screen and goes back a long distance, almost to infinite distance. It's the sort of haze that I've seen heaps and heaps of times at sea."

One of the byproducts of Series IV and V was the discovery that bulky films could be produced with somewhat larger holes than the films of Series I. The difference made by the use of the episotister is well illustrated by the following pair of reports, taken successively in the same observation hour. The first was taken without episotister in front of color, but with motor running, so that there was no auditory cue to the difference. The second was the same as the first, except than an episotister with 270° of orange was between the color and the back screen.

²⁷It will be remembered that the *Os* were not instructed to report upon hue. Hence these observations were spontaneous. It is possible that the other *Os* might occasionally have noted these differences, if the instructions had called for them.

H (6 O) "Quite definitely localized, bidimensional, fairly definite objective reference, in so far as it was a smooth surface (paper or anything of the kind). Solid, opaque." H (6 O, 270 O) "Very indefinitely localized. I don't know whether I can even say it was back behind the back screen. Bidimensional, I guess. There were moments when it seemed almost tridimensional. Hint of translucency. The term 'cloudy' is not adequate, 'filmy' is not adequate. It's just a bit of luminous color."

Series VI. Control Series

The best guarantee of the validity of experimental results is agreement among a number of trained Os. Our quotations have shown that there was in fact a very high degree of agreement. Series VI was planned as a further test of reliability. To see whether the use of the episcotister carried with it any imaginal suggestion which might have exaggerated the differences between the film colors of Series I and the bulky colors of Series IV, we turned the episcotister in such a way that it did not come in front of the colored background at all. The episcotister was left on the motor, so that it might run at the same speed and produce the same sound. The shadow of the episcotister fell on the wall some distance from the colored paper, so as to have no effect on its appearance. Since the colored backgrounds were tacked to the wall, they could not be jarred or in any way affected by the motor on the table. Hence it made no objective difference in the color whether the motor was running or not. The only difference between exposures during which the motor was running and those for which it was turned off was the sound. It was assumed that the sound might act as a suggestion to the Os that they were seeing the same sort of thing as in Series IV and V. Between exposures *E* moved the motor about so as to suggest, by sound again, that the episcotister was being put in front of the color or removed. No verbal suggestion was given.

The screen openings used were 3 and 0 (8 and 2 cm. respectively): screen 3 because it was that most frequently used in the series to be tested, and screen 0 because it had invariably given film in Series I. With Os A and Br screen 6 (14 cm.) was also used for purposes of comparison.

In every case the Os immediately or almost immediately discovered that the two experiences were identical. Br and A were absolutely unaffected by the suggestion. H, as was shown by the cautious and hesitating nature of his reports, was apparently affected by the suggestion in the first two observations, but in the third he settled down to objective report, and thereafter found no difference between the appearance of the color when the motor was running and when it was not. Fifteen subsequent trials failed to show any the least trace of suggestion. Similarly, Bi showed a possible slight effect of the suggestion in the first three trials; but even here the differences reported were scarcely

greater than those occurring in the course of a normal series; and his reports in 15 subsequent trials were entirely free from evidences of suggestion. This record affords objective proof of the reliability of the *Os*.

IV. THE MONOCULAR FILM

Series VII. Holes of Various Sizes

In this series the apparatus and procedure were identical with those of Series I, except that, instead of making all observations binocularly, the *Os* were asked to alternate binocular and monocular observations and to compare the two.²⁸ The reports of all *Os* showed that with monocular observations size of hole makes less difference than with binocular. In every case the color appears as an almost bidimensional film, which tends to lie in the same plane as the back screen. In having less suggestion of tridimensionality about it than the binocular films of previous series, these monocular films are closer to the typical film as Katz conceives it. The following comparative observations illustrate this point.

H (°, l) ²⁹ "With one eye the two holes seem very much in the same plane. . . . The color was just color. Non-objective and unlocalized. It was certainly behind the cardboards, but I couldn't tell more than that. It tended to come up close against the card. Dull, opaque, fuzzy, soft. Slightly suggestive of translucency; not much. Neither bidimensional nor tridimensional. Bidimensional spread is clear enough, but there is nothing definite about the third dimension. Tridimensionality is suggested rather in the softness, the fuzziness, the sponginess of the thing than in anything else." H (°, r) "Little difference between the two eyes. The texture was perhaps a little less fuzzy and soft, but still suggested the third dimension." H (°, b) "Funny how that changes! With two eyes, there is a definite space between the screens. The second was definitely 20 cm. behind the first. The color was still non-objective, localized at or behind the second screen. More certainly tridimensional, though not in any determinable amount. The texture was more translucent, more motile, as though there were liveness in the color. I think that's probably what we have called luminosity. More dense, glass-like; not clear, transparent glass, but a little more solid." Bi (°, r) "Equally filmy, but pretty much up to the hole. I tried to force my eye back in it, and it didn't work somehow. It left me with something that was not deep in the third dimension, but not surface." Bi (°, l) "I have a feeling that I ought to be able to force that film to be deep, but I don't believe I can. I can pierce it a bit, but it stays pretty much a flat, dense film at the hole." M (°, b) "Indefinitely localized, except somewhere behind the back screen. Non-objective. Soft, loose, penetrable texture. Dimensionality uncertain, but tridimensionality is at least strongly suggested." M (°, r) "Non-objective, just a patch of color in the hole. Soft, thin, filmy. Probably bidimensional, though here (*i. e.*, in monocular observations), where differences of localization are not

²⁸We took our cue for this monocular series from Katz' suggestion that monocular observation of ordinary objects affords a mode of appearance intermediate between film and surface: *op. cit.*, 9.

²⁹Small letters after the comma in the parentheses indicate the mode of observation. Thus l means "with the left eye;" r, "with the right eye;" and b, "with both eyes."

so noticeable, dimensionality also seems equivocal. All things seem shoved up more nearly into the same plane. The front screen, the back screen, and the color all lie, or at least look as if they might lie, in the same plane." Br (2, b) "Soft, filmy brown medium. Localized near the hole and yet it seems to go back a bit from that. Dense, cloudy appearance." Br (2, r) "Same, except that it's like a plane, even, fine-textured cloth at the hole; really a film, but I can imagine a cloth like that; one of those soft georgettes." Bi (2, b) "I have a suspicion that there's a deeper film with two eyes than I saw with a single eye. The one with both eyes is like a fog; the one with one eye is like a rotating disc." Bi (2, r) "I looked for the deep character that I thought I saw before. It is not there with the single eye, though what I saw was certainly not a surface. It still had a filmy character." A (2, b) "I see a brown misty thing up in the hole and behind it, too." A (2, r) "I can't say whether it looked up at the screen or behind, but it wasn't misty-looking as it was when I saw it with two eyes. More surfacey. Not a slick surface. More like blotting paper."

Thus it is evident that monocular observations with the small holes gave a flatter, more nearly bidimensional color than did the binocular observations.

With the larger holes, the reverse proved true. Although the object could now be easily identified, it did not appear to have so sharply defined a surface as in the binocular observations.

M (9, b) "Ordinary cloth, definitely localized behind the screen." M (9, r) "Positively cloth, but greatly softened, and not a sharply defined surface. Velvety. Not much space between fore and back screens or between back screen and cloth. All are in nearly the same plane. Less certainty of localization than when viewed binocularly; or rather, less positiveness of difference in localization. The very question of localization seems out of place in these monocular observations." H (9, r) "Little difference monocularly between this and the last (hole no. 2, 6 cm.). Opaque, softened, a little more certainly behind the screen when I use the side of the hole as a reference point, but not when I look straight at it." H (9, b) "Fairly sharp surface. No hint of softness. Certainly a colored something. Cloth, or it might be a colored wall. Localized very definitely behind the second screen at a distance of 20 cm., more rather than less. No suggestion of depth, just an opaque, solid substance." Bi (8, b) "I get a film that goes all the way back to the background, but I can nearly see the cloth, if it is cloth. The cloth was away back by the wall. The haze was everywhere between the cloth and the hole. Part of the time it seemed equally dense throughout, and part of the time it seemed thinner up in front and denser behind." Bi (8, r) "Dense film. Thick plane at the screen. It huddles up to the front. It stays up. I can't force my gaze back through it." Br (8, b) "Surface, some distance behind second hole. Flat piece of cloth." Br (8, r) "Film, which is difficult to distinguish as film, because it seems that flat plane, lying on the back hole." A (9, b) "Back behind screen, 8 or 9 in., and now it looks with two eyes very much as it did with one a while ago, although it has more quickness and liveness." A (9, l) "Right up in the screen, and a little duller than before. By dull I mean that it hasn't that quick, lively look."

From these and similar observations it is evident that, with monocular observations, the largest holes like the smallest gave an appearance of filmy texture. In fact one O (H) remarked: "The one-eye appearance is nearly uniform for the whole range of sizes."

For the sake of completeness we append a few typical observations taken with intermediate sizes of holes.

Br (4, b) "More filmy and behind the back hole. I couldn't say whether it was really bulky. Indefinitely localized. No definite front surface." Br (4, l) "It looked a little more flat and seemed more a plane, but not as definitely a plane as when I saw it binocularly through those large holes." Br (4, r) "Same. Filmy, soft, fuzzy appearance, but not so thick as when I saw it with both eyes." Br (6, b) "Filmy, thick, dense, foggy." Br (6, r) "Flat, even, filmy thing; really like a spectral color hung in space." Br (6, l) "Same. More plane and even than with both eyes." M (4, b) "Brown surface, seen dimly and localized with difficulty behind a brown medium of increasing density which lies somewhere behind the back screen. The surface is cloth." M (4, r) "Brown cloth, but very soft, thin, and filmy. The brown might be at, or even slightly in front of, the screen. Certainly there is not much if any difference of distance between the screen and the color, or between the two screens; but the screens themselves are not localized with any degree of precision. Not so much suggestion of tridimensionality as with two eyes, but the surface character is not positive either."

Without stopping to multiply illustrations we may therefore say that, throughout our whole range of holes, including those that were large enough to permit a recognition of the object, monocular observations gave appearances which in texture, dimensionality, and indefinite localization approximated fairly closely to the Katz film.

Series VIII. Monocular Observations with Episcotister

Obviously the next step was to find out what happens to bulky colors under monocular observation. For this purpose we used an experimental arrangement identical with that of Series IV. In the episcotister we used dark blue, orange, and various combinations of the two. The background was a sheet of dark blue paper with a black fixation spot in the middle. As in Series VII, monocular and binocular observations were alternated for purposes of comparison. It was found that, whereas binocular observations with a suitable amount of color in the episcotister gave good bulky color, monocular observation reduced this to a filmy appearance.

H (3 BL, bk, 180 BL, b) "The spot was definitely 25 or 30 cm. behind the back screen. It tended to give considerable depth to the color. The color was transparent, dense, glassy, flinty. It was still non-objective. I don't know whether the color filled all the space between the screen and the dot, but it tended to have that meaning." H (3 BL, bk, 180 BL, r) "More nearly flat in form. Non-objective, but it suggested some kind of soft surface. Quite opaque. No translucency or transparency. The color was localized back at the dot. I don't think the color or the dot either was quite as definitely localized as the dot was before (*i. e.*, binocularly), but the color was with the dot." H (3 BL, bk, 180 O, b) "The fixation point was definitely 25 or 30 cm. behind the back screen. The color itself was certainly non-objective and pretty definitely tridimensional; a mass, almost a body of it, extending from the region of the screen back to the dot. I couldn't be sure whether it extended clear to the dot or not. Translucent, soft, not much glassy." H (3 BL, bk, 180 O, r) "The color and dot

seemed to lie together and tended to be localized nearer the screen, but there was not absolute definiteness of localization. Less massiveness to the whole experience, but yet not a definite surface with objective reference. Soft, fuzzy, suggestive of tridimensionality but not in the same sense. The whole thing is dead, static, more like a soft surface. No suggestion of translucency or transparency." A (3 BL, bk, 270 BL, b) "I saw tridimensionality that time. Thick fog came up to the hole. I could see into it. I couldn't tell how far it extended. The fixation point was in it somewhere." A (BL, bk, 270 BL, r) "Bidimensional, as if I were looking at something that let the light through; but I saw it in two dimensions. Like thick colored glass that's soft-looking, but you don't see anything but the front of that glass; like glass in church windows. If you didn't know it was glass you'd hardly call it glass. Not transparent, but translucent." A (3 BL, bk, 270 BL, b) "I couldn't help seeing it as tridimensional. I tried to hold it in the same place as with one eye, but I couldn't. The two things don't look anything alike." Br (3 BL, bk, 210 BL, b) "Bulky, dense medium. The fixation point was buried in it somewhere." Br (3 BL, bk, 210 BL, r) "Flatness, filminess, rather than surface, and yet it's all in one plane, or almost all in one plane. With two eyes you seem to be looking into something almost glassy-like. This is like the blue of the sky. This has the appearance of being penetrable, but you don't have that impression of seeing space that you have with the other." Bi (3 BL, bk, 180 BL, b) "Hazy smokiness which goes clear back to the fixation point. It's open and loose. I didn't see it come clear up to the screen. I didn't see it fall short either." Bi (3 BL, bk, 180 BL, l) "This tended with one eye to be flat. The fixation point tended to come up to the screen. Anyway they got crowded together." M (3 BL, bk, 270 BL, b) "Fixation point badly blurred and localized with difficulty in a dense, semi-transparent fog, which began at or near the back screen and went back an uncertain distance." M (3 BL, bk, 270 BL, r) "Color and fixation point are both filmy, and seem to lie in approximately the same plane as the screens. Both screens seem to lie in very nearly the same plane. No part of the total experience is localized with any degree of precision. The color appears soft but not actually penetrable. It is non-objective."

Hence it is evident that all the color appearances which we have here studied, when viewed monocularly, take on a more or less filmy appearance. They become indefinitely localized, pre-textural, predimensional; and except where familiar configuration carries with it the meaning of a familiar object, as in the case of the screens themselves or the brown cloth as seen through the largest holes, they are also non-objective.

V. CONCLUSIONS

1. Our experimental results indicate that the simple visual datum is a "film," predimensional but tending more strongly toward tridimensionality than Katz' bidimensional *Fläche*. The film is also pretextural, non-localizable, and non-objective. It has an attributive character of spatial spread or diffusion, to particularize which we must have recourse to qualified perceptive analogy.

2. There are no psychological intermediates between film and surface. Our results show a sharp break between the true film and the immersed surface, the haziest of the surfaces, a

break which involves a complete change of attitude. The localization of the color in the case of the surface is the determining factor in the shift from film to surface.

3. Between film and bulky color the shift of attitude is more tentative and cautious, and the transition is in a sense more gradual. There are, nevertheless, no true psychological intermediates.

4. There is a wealth of phenomenological intermediates, any one of which might have been stabilized as a perception if our everyday experience had required such stabilization.³⁰

³⁰We make no claim to have reviewed the whole series of intermediates. It is possible that another approach to the general problem, and in particular the bringing to bear upon the film of strong perceptive motives other than that of localization, might lead to another classification and might reveal new phenomenological modes. We can say, however, that in a good deal of casual experimenting, such as naturally suggested itself in the course of an investigation like the present, we have found no 'leads' toward a further variety of visual appearance at the level of our enquiry.